INERTIAL CONFINEMENT FUSION — Lawrence Livermore National Laboratory

Monthly Highlights

March 1998

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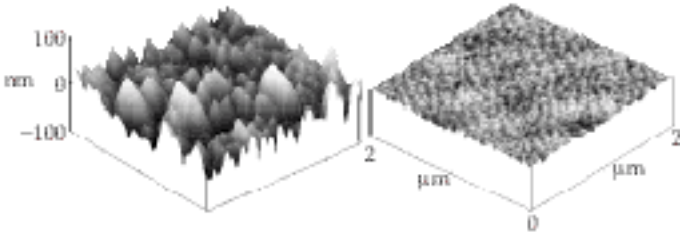
Copper-Doped Beryllium for NIF Capsule.

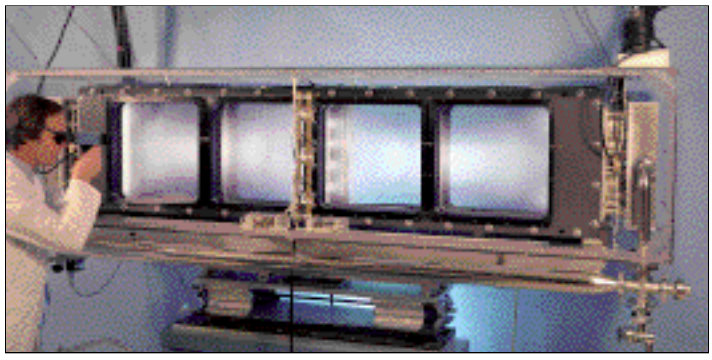
The ablator material for a NIF ignition capsule is important to the target performance. Copper-doped beryllium is one of several ablators being developed by a team from the Lasers and Chemistry & Materials Science Directorates. To improve the smoothness of our sputter-deposited beryllium (Be) films, we have been studying the effects of adding boron (B) to this capsule at various concentrations. Experiments on planar substrates have shown that at approximately 11 atom%B, there is a rapid decrease in grain size, resulting in a significant reduction of surface roughness. Below are two atomic-force-microscope (AFM) images of B-doped films, both ~5 microns (μm) thick. The image on the left is from a film containing 9 atom%B and has an RMS roughness of 19 nanometers (nm) over the 2-μm × 2-μm sample. The image on the right is from a film with 13 atom%B and has a roughness of only 2.5 nm RMS. A NIF Be capsule with total surface roughness less than 50 nm ignites in implosion computer simulations.



AFM images of Be at 9 atom%B (left) and 13 atom%B (right).

NIF Prototype PEPC.

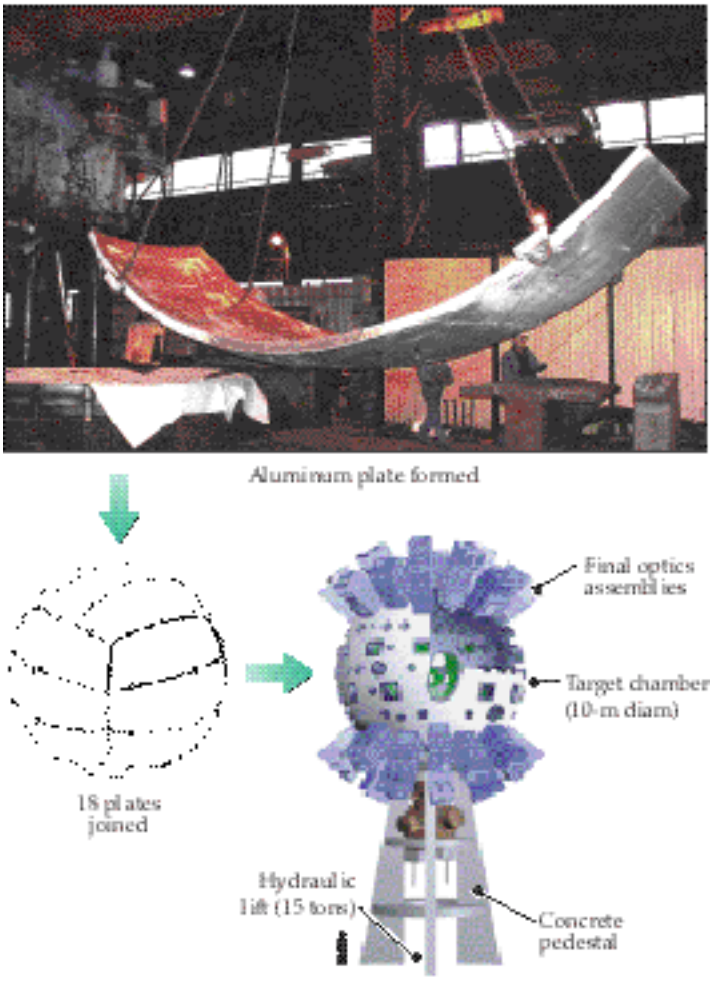
The plasma electrode Pockels cell (PEPC) allows polarization switching of laser beams through NIF-scale apertures, enabling the multipass amplification and parasitic oscillation suppression that the NIF laser design requires. We have developed the NIF PEPC in 4 × 1 line-replaceable units that fit into the NIF's 4 × 2 beamline bundles. The multi-aperture PEPC design is based on fundamental modeling, validation experiments, and cost optimization and is advanced far beyond the Beamlet design. The PEPC is still undergoing electro-optical testing, but initial tests indicate that it exceeds NIF design requirements.



The prototype 4 × 1 PEPC, shown horizontally, will be vertical on the NIF.

NIF Target Chamber Coming Together .

Fourteen of eighteen aluminum plates for the NIF's 10-meter target chamber have been formed. The aluminum plates, shown below, are hot-formed at 316°C in a 12,000-ton press. The plates will be shipped weekly in pairs to a shop under contract to Pitt-Desmoines Steel, where machining of weld joints on the first plate has already begun. The target chamber will eventually rest on a concrete pedestal, also shown.



18 aluminum plates join to form the spherical NIFtarget chamber .

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